DOCUMENT RESUME

ED 218 484 CE 032 941

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TITLE Applying Instructional Systems Development to On-the-Job Training.
PUB DATE 82
NOTE 33p.

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Curriculum Development; *Material Development; Military Training; *Models; *On the Job Training; Postsecondary Education; Skill Development; *Systems Approach; Systems Development
IDENTIFIERS Air Force; *Instructional Systems Development Model

ABSTRACT

Although the Instructional Systems Development (ISD) model, based on behavioral theory, has been in use for several years, especially in military training, applying the systems approach to the curriculum development of on-the-job training material is a new use for it. The ISD model consists of five steps: (1) analyze system requirements; (2) define education/training requirements; (3) develop objectives and tests; (4) plan, develop, and validate training; and (5) conduct and evaluate training. ISD allows for continuing changes in the instructional system to match changes in the operational system shown in the model as a two-way feedback loop which runs between all steps. Changes identified in any step of the model can be compensated for by changing the system where needed. This flexibility, afforded by ISD, coupled with the "front end loading" of basing the whole instructional system on operational requirements, makes on-the-job training programs uniquely practical and economic. (The author illustrates the use of the ISD model for curriculum development of on-the-job training materials through the development of the Qualification Training Package.) (KC)

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APPLYING INSTRUCTIONAL SYSTEMS DEVELOPMENT TO ON-THE-JOB TRAINING

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Applying ISD to On-the-Job Training

Allan T. Perkins

Air Force Communications Command Training Development Branch (USAF)

1982

This paper addresses a new application for the Instructional Systems Development (ISD) model of curriculum development. The author explains how one organization uses ISD to effectively develop On-the-Job Training (OJT) materials. Each step of the process is explained in detail with emphasis on practical application of the procedures covered.

ACKNOWLEDGEMENT

Many of the theories, ideas, and concepts required to apply ISD to an On-the-Job Training environment were developed by the members of the Air Force Communications Command Training Development Branch. Especially in the early days of the unit, a great deal of time was spent brainstroming ideas and then working together to fit all the pieces into a practical program.

I would like to thank everyone who took part in this process. Each person involved was dedicated to developing a practical program, and that program is presented here.

ALLAN T. PERKINS

CHAPTER ONE

BACKGROUND INFORMATION AND INVOLVEMENT

INTRODUCTION

The Instructional Systems Development (ISD) model,[1] and several other models based on behavioral theory, has been in use for several years. These models have been successfully used for all types of formal training programs, both in and out of the military. Applying the systems approach to the curriculum development of On-the-Job Training (OJT) material is a new twist, however.

This paper will present the Qualification Training Package and the procedures used to develop the package. The procedures presented here were developed by and for the Air Force Communications Command Training Development Branch, but they can easily be applied to almost any organization which relies heavily on OJT to meet training requirements.

The unique part of this program is the vehicle used to deliver the needed training. It is called the Qualification Training Package, and can be provided in almost any media mix. The complete four part package provides all that is needed in the operational unit. (This is so because equipment, tools, and such are already assigned to each unit

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[1] A copy of the ISD model is shown as Attachment #1.

as part of the operational system.) The four parts of the Qualification Training Package are:

1. The Command Job Proficiency Guide (Used to plan the individual's training to meet both organizational and personal needs. Also used to document the completed training.)

2. The Trainer's Guide (used to provide instructions on the use of the package to trainers, supervisors and other concerned persons.)

3. The Skill Training Material (the actual training materials plus review exercises, performance exercises, charts, wiring diagrams, etc.)

4. The Knowledge Evaluation Pamphlet (the final evaluation of the trainee's learning.)

While this approach is too new to say conclusively, all indications from the users suggest that the Qualification Training Package will prove to be a successful answer to the problem of developing usable, practical training material for individual study, while still ensuring standardization throughout a large organization.

It should be noted that the course used as an example for this paper is not part of an official training program of the Air Force. The course was made up by the author as a working example for this paper. This was done to solve two conflicting problems: (1) how to provide a sample program

which can be used to demonstrate all procedures used to develop a Qualification Training Package using ISD, and (2) how to keep from compromising any training programs currently in use in the military.

AGENCY INVOLVEMENT

On 1 January 1980, the Air Force Communications Command (AFCC) created the Training Development Branch. This organization was made responsible for developing maintenance proficiency training, knowledge training materials, and other OJT materials required throughout the command. The Training Development Branch was also given primary responsibility for all ISD efforts within the command.

PRELIMINARY RESEARCH

Normally, the Training Development Branch becomes involved in a project when a formal request to consider it as a candidate for Qualification Training Package development has been received. When such a request is received it is assigned to the appropriate curriculum Development Manager to perform a Pre-ISD analysis.

This analysis consists of gathering all the data needed to make an intelligent decision about whether or not the project in question warrants the large expenditure of time and manpower required to develop a training package using the ISD model. Information gathered and analyzed at this stage in the process includes:

1. The size of the equipment system involved.

2. The number of personnel involved.

3. The suitability and availability of any training previously developed.

4. The accuracy, completeness, and availability of technical data.

Once this data has been received and analyzed a planning meeting is held. The meeting will include the Chief of the AFCC Training Development Branch, the Curriculum Development Manager, a representative of the Education/ Evaluation Section of AFCC Training Development Branch, and any other concerned individuals. At this meeting the decision is made to either perform steps I and II of the ISD model, with an eye toward developing a Qualification Training Package, or not. If the project is not to be pursued further, the originator of the initial request is informed and provided with the rationale for this decision. If the project is to continue through ISD steps I and II the Curriculum Development Manager will assign the project to the proper Curriculum Development Technicians.

CHAPTER TWO

APPLYING ISD STEP I

The normal first step in the process is to determine the broad tasks involved in the work being considered. (Note that at this time no thought is given to training, training requirements, or education; at this point in the process all that is being considered are the job requirements. What tasks and knowledge items are needed to perform the job?)

One tool found to be very useful for the purpose of determining the job requirements is the Task List Worksheet shown in Attachment #2. Information to determine the tasks to be listed might be found by:

1. Searching technical publications and data.

2. Requesting information from the equipment manufacturers.

3. Surveying experienced personnel in the field.

4. Working from personal experience.

The form provided has spaces in which to identify the task, identify the system or equipment the task is performed on, list technical references where more information can be found, and show suggested task sequencing information. The form also has a short space for remarks.

A separate Task List Worksheet is made up for each task required. Once all tasks have been identified, the worksheets are arranged in that order which best fits their relative sequencing on the job. Experienced personnel who

are performing in the field are then consulted to determine if the task list agrees with the latest practices. This "field check" also gives the developer an insight into tasks which are performed at one location, but not required at another. In addition, this procedure allows the field personnel a chance to take take part in the development process. This is important because when personnel in the field feel like they have a part to play in the development process they more readily accept the finished product.

Once all tasks have been identified, verified with field personnel, and sequenced, it becomes time to convert these tasks into comprehensive job requirements. While much of the information needed can be taken from the Task List Worksheets previously completed, much more information is required. A Task Description Worksheet is used to record the information needed at this stage of the process. The Task Description Worksheet is used in more than one step of the ISD model. Only those portions shown in Attachments 3a and b are completed at this time. In addition to the information obtained from the Task List Worksheet, the following information is recorded on the Task Description Worksheet during ISD Step I:

1. General Training Factors: to include the number of people to be trained, target population information, and information on resources presently available plus resource needs which can be projected for use.

2. Task Specific Training Factors: to include task criticality, frequency of performance, percent of the target population performing the task, number of persons performing the task, the task learning difficulty, an estimate of the time needed to develop training on this task, and task performance difficulty.

3. Supporting information: to include rules used, assumptions made concerning the task or target population, etc.

4. The task statement is transferred from the Task List Worksheet, then information on each activity (skills or knowledge) required to perform the task is provided.

A Task Description Worksheet is prepared for each task involved in the work being considered. (This procedure may seem like a lot of paper work, but a Task Description Worksheet for each task is a must if the training is to be all that is needed for the job and only what is needed for the job.) All further actions taken in the ISD process will develop from the information found on the Task Description Worksheets.

CHAPTER THREE

APPLYING ISD STEP II

In this step of the ISD process, the training requirements for each task are identified by using information required in part four of the Task Description Worksheet. This information, to include knowledge, skill, and practice information, is recorded on the Task Description Worksheet in the area shown as Attachment 3c of this paper. Also, at this time, the Task Description Worksheet is annotated to show whether or not training is required for each task. To determine if training is needed on a given task you might ask the questions:

- How much training is needed?

- What type of training is needed?

- How much of the needed training is already provided?

Once this entire analysis process has been completed for each task it becomes time to determine if a training program is really needed. This determination is normally made by a committee who has studied the information provided on the Task Description Worksheet. The "go-no go" committee is normally staffed in the same manner as the planning meeting described during the discussion of the preliminary research step. The Manager may have developed a summary of information from the Task Description Worksheets for each committee member to use, thus preventing the need to read each one. (It is not uncommon to have 50 or more Task Description Worksheets for each project.)

If it is determined that an instructional system is not needed, t is information is completely documented, all

concerned agencies and personnel are provided the complete rationale, and the entire package is filed for future reference. If an instructional system is to be designed then the Curriculum Development Manager will assign primary and alternate developers, as needed, to complete the program.

CHAPTER FOUR
APPLYING ISD STEP III

OBJECTIVES

Once it has been decided to initiate the development of an instructional system, the next step is to write the objectives. The Task Description Worksheets are useful in this step also. The task statement on the worksheet can be used to write one or more objective for each task listed.[2]

When using the ISD process objectives are always written in strictly behavioral terms. This requires an objective to have a behavior, a standard, and at least one condition. An objective worksheet may prove helpful in constructing the objectives.[3]

MEASUREMENT ITEMS

Once objectives have been written to show which behaviors must be accomplished to complete the course of study, measurement items are written to determine that the objective has, indeed, been met. These measurement items should be both written and practical in nature.

Practical tests are felt by some to be easier to construct and administer. Part of the reason for this is in the nature of the test. Any activity which shows that the skills or knowledges studied have been mastered will serve as a practical exercise. Such practical measurement items may very effectively show the student has mastered several important areas of study.

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[2]See the column entitled Behavior, Conditions, and Standards in Attachment 3b.

[3]An objective worksheet is illustrated as Attachment 4.

The following is an example:

> "You (the students) will work in teams of 4 people each. Each team will fully layout the room, designated by the instructor, in preparation to receive the equipment described in the scheme package. You can obtain all tools and materials you might need from the instructor. Use all safety precautions and standard procedures."

This item measures, to one extent or another, each of these areas important to the completion of the task:

- Scheme package composition
- Practical geometry
- Metric conversions
- Tool selection and use
- Team working ability
- Use of technical data
- Interpreting drawings
- Knowledge and application of safety precautions
- Knowledge and application of standard procedures

Written measurement items are fairly common, and little needs to be said about them. One thing should be noted however; objective items are preferred. When dealing with a trade skill, where safety is an intrinsic part, the student must be sure he is doing the right thing. If a measurement item does not ensure the students know what is expected of them, that item might do as much harm as good.

One more thing must be remembered about measurement items written for Qualification Training Packages. Items must be written for both practice quizzes and for the final measurement of the objective, so one or two items per

subject area is usually not enough. The developer must not write questions on trivia just to get extra items for a quiz, but instead, must cover the main points with different types of items. They must be written at slightly different levels or from a different angle of attack.

METHODS AND MEDIA SELECTION

After all objectives and measurement items are constructed, decisions are made as to what methods and media are to be used. Constraints, such as cost, must be considered in the process as well as needs. The best methods and media are those which meet the needs of both the instructional system as a whole and of the individual tasks being taught. As an example, assume that the communications site layout package being used to illustrate this paper, as a whole, represents material that parts of the target population received during informal training developed in the past. But the metric conversions portion is brand new; no students had taken it before. So, while it might be decided to offer most of the program in a format which combined classroom instructions with practical experience in the laboratory, that would not be the case with metrics. Metric conversions might be offered as a programmed text. By providing the program in this manner those members of the target population who took the informal training earlier could take the metrics alone, and those who were completely untrained could be offered metric conversions as part of their normal classwork simply by allowing them to take the same programmed text. The programmed text could also be used as a review tool where needed.

The decisions on methods and media are made by the curriculum developer and manager, after consulting with representatives from the field and specialists in the various media and methods being considered.

CHAPTER FIVE

APPLYING ISD STEP IV

DEVELOPING INSTRUCTIONAL MATERIALS

We are now at the point in the ISD process at which we develop the actual materials used in the instructional system. Developing the system is a great deal more than "just writing the lesson plans". Some of the major areas looked at in this step are briefly outlined below.

All of those resources identified earlier in the process are coordinated and actions are taken to provide those which are not already available. In addition, any resources which might be needed due to the methods and media selected, or any other information not previously available, are also considered at this time.

If needed, course control documents such as the Course Charts, Syllabuses, etc., are developed now. These documents will serve as "Operating Instructions" for the classroom instructor, trainer, discussion leader, or facilitator. Program directors, instructor supervisors, and similar management personnel also find these documents useful in checking to ensure the actual instruction provided fits into the parameters of the program as developed.

If it is found desirable to use audio-visual materials, these must be developed. Scripts, storyboards, photographic subjects, and shooting schedules must be produced and coordinated with the organizations tasked with providing graphics and audio-visual support. Also, since these products represent extraordinary expenses, coordination must usually be made to ensure the funds are available.

All texts, workbooks, and programmed texts are also produced in this step of the ISD model. The actual writing would be accomplished by one or more Curriculum Development Technicians. The normal procedure then is to have other developers with experience in the subject area read the text and make their recommendations. Then the text goes to the Curriculum Development Manager in charge of the project who will review the project, making recommendations and corrections. Finally, the text will go through internal editing by the Education and Evaluation Section before being typed in final and sent to the printers. Education and Evaluation Section personnel will edit the draft manuscripts for grammar and punctuation. They will also check to ensure that the material provided is in an acceptable format and is educationally sound. The editors will also review the final copy of the manuscript to ensure everything is provided and that there are no errors.

If needed, instructions on the use of the system were constructed in this step also.

VALIDATING THE INSTRUCTIONAL SYSTEM

Once all of the materials have been constructed and reproduced, it is time to validate the system. This process is normally accomplished in three stages. They are the preparatory, survey, and analysis stages.

In the first stage of validation, several actions must be taken simultaneously. A sample population must be identified from the target population. This sample population is normally determined by (1) identifying the units which are to take part, (2) identifying the individuals in each unit who will take part, (3) ensuring that the sample represents a true picture of the target population (making sure all sub-groups are properly represented).

At the same time the sample population is being identified, the survey instrument is constructed. While a standardized validation instrument has been developed, additional questions can, and are, added when required. For example, if a new technique is attempted, additional questions on that new technique might be used in the instrument. In this way both standardization and flexibility are easily obtained.

Not much needs to be said about the actual survey instrument. It is usually written in a very down to earth manner, using the same maximum reading grade level used for the text. The questions chosen for the survey can usually be answered in one or two words so the survey can be quickly taken. But, each question also has ample space for remarks which are encouraged.

When all the survey results are returned, the third stage of the validation process begins. Large charts, which resemble the chi-square type of format, are constructed and the data is transposed onto them. The data is then analyzed to determine what changes should be made to better meet the needs of the field units. If a training module proves to be ineffective it will be rewritten or replaced. If an illustration is confusing to the technician in the field it will be replaced with a simpler one. If a group of modules prove to be unnecessary they will be deleted. In each case shown above, the training needs of the technician in the field is the deciding factor. What the technician doing the job needs, he gets. And, of course, if the program sent to validation proves to be the best product possible it is left alone.

CHAPTER SIX
APPLYING ISD STEP V

CONDUCTING TRAINING

After all the ground work of analyzing the job requirements, converting these into training requirements, developing the system, and validating it, the resulting instructional system may be used in the OJT environment.

The first step is to distribute the materials into the field where they may be used. The normal publications and audio visual distribution channels, already in place, are used for this. The personnel in the field now have a well-planned, useful instructional system geared to their operational needs.

EVALUATION OF THE SYSTEM

There is one thing left to consider -- operational systems and target populations change. If the instructional system does not move with these changes, if it cannot be easily changed with operational changes, then it soon becomes worthless.

To prevent the instructional system from becoming obsolete, it will be evaluated as needed (usually this is done at least annually). The evaluation should include, but

not be limited to the following:

1. A check of the operational system. Has it changed?

2. The training requirements. Do they still represent valid needs?

3. The objectives. Do they still cover the training requirements? Are there any requirements which are not covered by objectives?

4. The measurement items. Do they still measure the objectives? Are they still valid, objective, etc?

5. The instructional materials. Are they easy to understand? Is the subject material fully covered? Is there any nice-to-know information which can be deleted?

6. The methods and media. Are they still the best possible for the material, within the constraints? Are there newly developed methods or media which should be considered?

CHAPTER SEVEN
CLOSING REMARKS

If this entire discussion sounds like so much "nice theory" you can't really apply, this paper has missed the mark. ISD is very useful in developing any program where psycho-motor skills are to be taught. And the procedures outlined here have been proven in the effective development of more than 20 programs, with more being developed all the time.

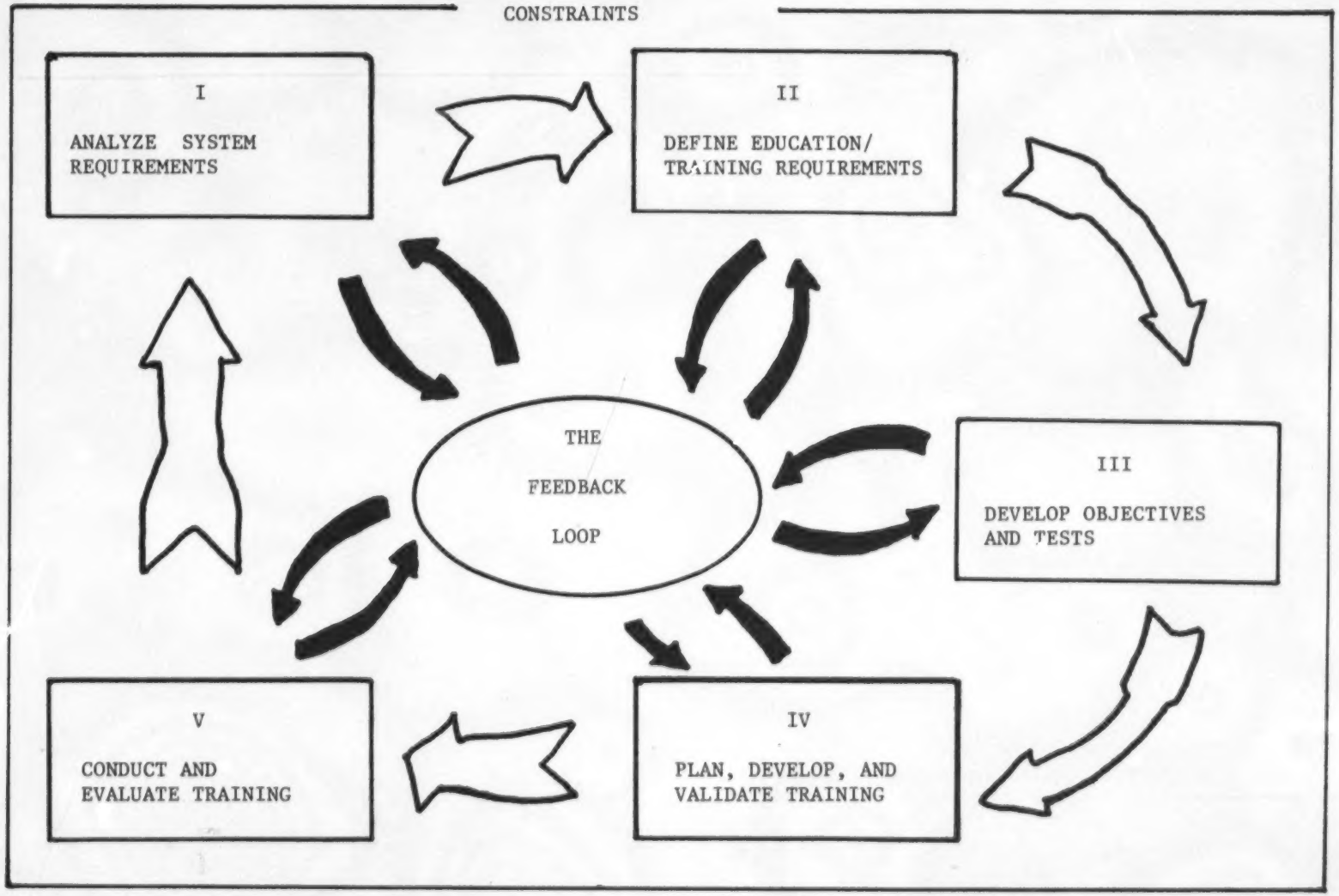
By now you will note that the ISD process is <u>not</u> a one shot program. You can't use ISD to develop a program and let it go on without further work. ISD allows for continuing changes in the instructional system to match changes in the operational system. This change process is shown in the ISD model (Attachment 1) as a two-way feedback loop which runs between all steps. Changes identified in any step of the model can be compensated for by changing the system where ever needed.

For Example: An old training requirement is no longer needed because the operational system no longer uses that skill. So objectives supporting that requirement are dropped from the system. As are the measurement items and training materials which support the objectives.

During the same evaluation a very high percentage of trainees were shown as having a difficult time meeting a given objective. Some of the time dropped because of the example above could be used here to strengthen classroom learning of the basic principles; in addition, time might be added to the practical application portion to strengthen skill mastery.

This flexibility, coupled with the "front end loading" of basing the whole instructional system on operational requirements, makes OJT programs produced using ISD uniquely practical and economic.

THE ISD MODEL



ATTACHMENT 1

TASK NUMBER: 27

TASK LIST WORKSHEET

TASK: Metric Conversions; inches/centimeters, feet/meters

SYSTEM: Site Layout (Installations Practices)

T.O. 31 - 10 - 94 PAGE(S) 2-3 thru 2-14 PARA(S) 2-8 thru 2-37

TABLE(S) 2-1

FOLD OUT/FIGURE(S)

TASK SEQUENCE INFORMATION:

A. PRIOR TASK(S) REQUIRED: 25 and 26

B. FOLLOW-ON TASK(S) REQUIRED: 29

REMARKS:

ATC Keesler 1-1985

ATTACHMENT 2

TASK DESCRIPTION WORKSHEET

ATTACHMENT 3a

PAGE 1 OF 1 PAGES	DATE: 28 MAY 1982	TASK #: 27	NAME: METRIC CONVERSIONS
ANALYST: MSGT PERKINS		SUBTASK #: 27a	NAME: FEET/METERS

SYSTEM, CAREER AREA, OR SPECIALTY IDENTIFICATION

STANDARD INSTALLATION OF COMMUNICATIONS EQUIPMENT

FUNCTION OR DUTY

SITE LAYOUT

STS REFERENCE

36XXXX

INFO SOURCES

TECHNICAL ORDER 31 - 10 - 94; PAGE 2-3 THRU 2-14, PARA. 2-8 THRU 2-37, TABLE 2-1.

REMARKS

REMARKS

TRAINING IS REQUIRED

TASK DIFFICULTY FACTOR 6.2 (ON A SCALE OF 1 TO 10)

GENERAL TRAINING FACTORS

NO. TRAINED PERSONNEL REQUIRED

2957

QUALIFICATIONS OF TARGET POPULATION

COMMUNICATIONS INSTALLERS TAKEN FOR ALL MAINTENANCE CAREER FIELDS

TIME INTERVAL NEEDED

IN 15 MONTHS

RESOURCE AVAILABILITY

INSTRUCTORS

4 PER LOCATION (IN PLACE)

FACILITIES

1 CLASSROOM AND 1 LAB (IN PLACE)

EQUIPMENT

NOT APPLICABLE

REMARKS

ALL CLASSROOMS ARE EQUIPPED WITH STANDARD FURNITURE.

TASK SPECIFIC TRAINING FACTORS

TASK CRITICALITY

SEMI-CRITICAL

% PERFORMING THE TASK

71.52%

NO. PERFORMING THE TASK

2115

FREQUENCY OF PERFORMANCE

FREQUENCY OF PERFORMANCE

MONTHLY

LEARNING DIFFICULTY

MODERATE

TRAINING DEVELOPMENT TIME

5 MONTHS

REMARKS

ATTACHMENT 3a

AFCC FORM JUNE 80 444

ATC Keesler 1-1094

JPR CODE	TASK/ACTIVITY DESCRIPTION: ACTION — ACTION AND ITEM ACTED UPON / BEHAVIOR	TASK/ACTIVITY DESCRIPTION: ACTION — ACTIVITY SUPPORT ELEMENTS (EQUIPMENT, MATERIALS, PERFORMANCE AIDS) / CONDITION	TASK/ACTIVITY DESCRIPTION: INPUT(S) — ACTION DETERMINANT(S)	TASK/ACTIVITY DESCRIPTION: OUTPUT(S) — PROFICIENCY REQUIREMENTS / STANDARD	SUPPORT INFORMATION	
					1	ASSUMPTIONS
					2	RULES, DEFINITIONS, PRECAUTIONS, REFERENCES
					3	CONTINGENCIES
					4	REMARKS
TASK						
27a	CONVERT LENGHT MEASUREMENTS BETWEEN FEET AND METERS	(1) USE TECHNICAL ORDER 31-10-94 (2) CALCULATORS WILL NOT BE USED	PERFORM AS REQUIRED	80% CORRECT	1 2	THE STUDENT CAN PERFORM SIMPLE MATH FUNCTIONS CONVERSION FORMULAE PROVIDED
ACT.						
.1	CONVERT FEET TO METERS	1 and 2	PERFORM AS REQUIRED	80% CORRECT		
.2	CONVERT METERS TO FEET	1 and 2	PERFORM AS REQUIRED	80% CORRECT		
.3	SOLVE CONVERSION PROBLEMS	1 and 2	PERFORM AS REQUIRED	80% CORRECT		

KNOWLEDGE			SKILL			KNOWLEDGE CODES
PRACTICE	NO PRACTICE	PROFICIENCY LEVEL	PRACTICE	NO PRACTICE	PROFICIENCY LEVEL	A = ASSOCIATION C = CHAIN D = DISCRIMINATION CL = CLASSIFY RU = RULE USE PS = PROBLEM SOLVING
						NOTES
X		c	X		3	RU/PS (See the chart above)
X		c	X		3	RU
X		c	X		3	RU
X		c	X		3	RU/PS

: Zeeeler 1-1093

TASK/ACTIVITY WORKSHEET (ISD)

ATTACHMENT 4

OBJECTIVE(S) WORKSHEET

CJPG # 36XXXX Module # 27a

CJPG TASK # 27 TDW Page # 27a

OBJECTIVE STATEMENT(S):

GIVEN TECHNICAL ORDER 31 - 10 - 94 SOLVE TEN PROBLEMS INVOLVING METRIC CONVERSIONS TO 80% ACCURACY.

SPECIFIC AREAS TO BE TESTED:

METERS TO FEET CONVERSIONS

FEET TO METERS CONVERSIONS

PROBLEM SOLVING

REMARKS:

TAKE THE SAMPLE PROBLEMS USED FOR TESTING FROM ACTUAL JOB SITUATIONS RECENTLY ENCOUNTERED.

AMC Booklet 3-0316